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IS 7587-2 (2006): Cage Suspension Gear for Winding in Mines, Part 2: Cappels [MED 8: Mining Techniques and Equipment]

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खानों में वाईडिंग के लिए केज सस्पेंशन गियर — विशिष्टि

भाग 2 कैपल्स

(पहला पुनरीक्षण)

Indian Standard

CAGE SUSPENSION GEAR FOR WINDING IN MINES — SPECIFICATION

PART 2 CAPPELS

(First Revision)

ICS 73.100.40

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

September 2006 **Price Group 7**

Mining Techniques and Equipment Sectional Committee, ME 08

FOREWORD

This Indian Standard (Part 2) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Mining Techniques and Equipment Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard was first published in 1975. The experience gained in implementation of the standard has necessitated this revision.

This standard deals with the cappels used for connecting up the rope to the other parts of the suspension gear.

This standard has eight parts. The other parts in this series are:

Part 1	General requirements
Part 3	Shackles and pins
Part 4	Bridle chains
Part 5	Distribution (Equalizing) plates
Part 6	Safety detaching hooks (4 plate type) 80 and 100 kN capacity
Part 7	Safety detaching hooks (4 plate type) 120, 150 and 200 kN capacity
Part 8	Clivey hook suspension arrangements

A brief description of different types of cappels is given in Annex A.

The Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2:1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

CAGE SUSPENSION GEAR FOR WINDING IN MINES — SPECIFICATION

PART 2 CAPPELS

(First Revision)

1 SCOPE

This standard (Part 2) prescribes the minimum requirements for cappels employed in winding operations in mines.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
25 : 1979	Specification for antifriction bearing alloys (*third revision*)
1030 : 1998	Carbon steel castings for general engineering purposes (*fifth revision*)
3937 (Part 2) : 1974	Recommendations for socketing of wire ropes: Part 2 Socketing with white metal (*first revision*)
4218	Metric screw threads:
(Part 1) : 2001	Basic and design profiles (*second revision*)
(Part 2) : 2001	General plan (*second revision*)
(Part 3) : 2001	Basic dimensions (*second revision*)
4432 : 1988	Case hardening steels (*first revision*)
5517 : 1993	Steels for hardening and tempering — Specification (*second revision*)
7587 (Part 1) : 2004	Cage suspension gear for winding in mines: Part 1 General requirements (*first revision*)
14962	General purpose metric screw threads — Tolerances:
(Part 1) : 2001	Principles and basic data
(Part 2) : 2001	Limits of sizes for general purpose external and internal screw threads
(Part 3) : 2001	Deviations for constructional screw threads

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Capping — The completed rope end terminal by means of which the rope is coupled to different parts of suspension gear.

3.2 Cappel — The conical enlargement of the rope end, in a capping.

3.3 Basket — The tapered portion of the socket.

3.4 Seizing — The wire wrapped around the rope to hold its wires in position when cutting or capping the rope.

3.5 Socket — The metallic body of the cappel.

4 TYPES

The cappels shall be of the following two types:

a) *Type A* — White metal socket cappels with open jaws (*see* Fig. 1).

b) *Type B* — Tapered friction wedge cappel (*see* Fig. 2).

5 GENERAL REQUIREMENTS

The cappels shall comply in all respects with the requirements laid down in IS 7587 (Part 1).

6 MATERIALS

All parts of cappels shall be manufactured from the materials specified against each:

Cappel Parts	*Material*
All steel parts other than wedges and safety blocks	Steel conforming to 20C15 of IS 5517 or to 20Ni2Cr2Mo2 of IS 4432
Capping metal	Bearing alloy conforming to Grade 5 of IS 25 (metal to be free from zinc; other impurities shall not exceed 0.2 percent)

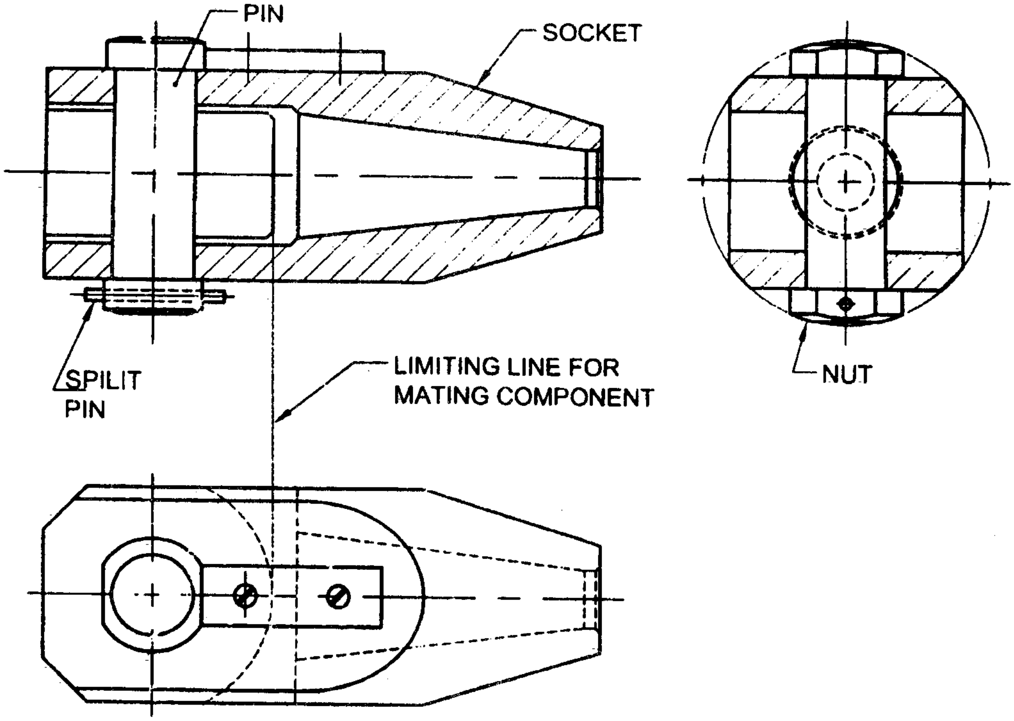


FIG. 1 ASSEMBLY OF WHITE METAL SOCKET CAPPEL WITH OPEN JAW

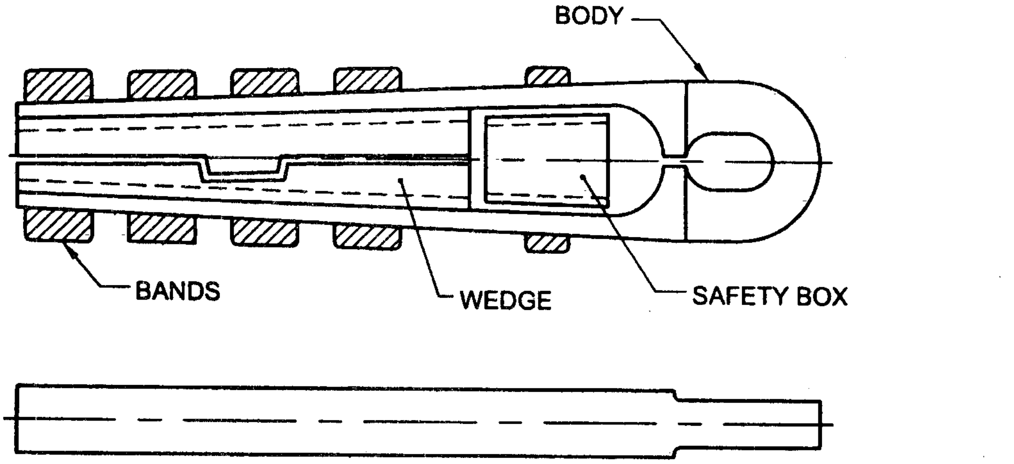


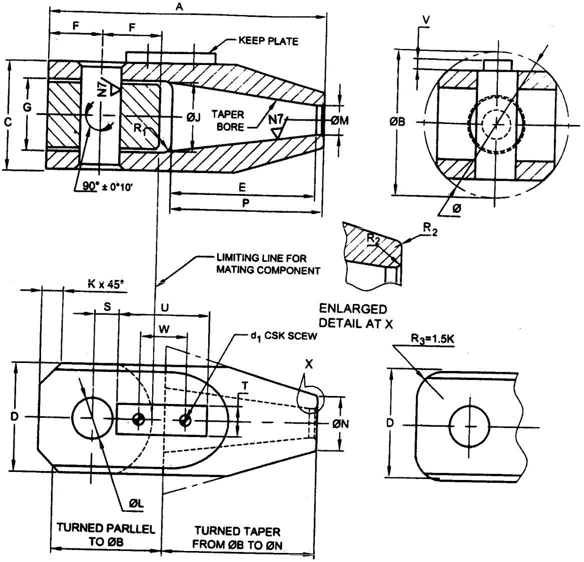
FIG. 2 ASSEMBLY OF TAPERED FRICTION WEDGE CAPPEL

Cappel Parts	*Material*
Wedges and safety blocks	Carbon steel castings conforming to Grade 2 of IS 1030. Alternatively steel of grade 20C15 of IS 5517 may be used after forging and normalizing with hardness varying between 170 and 190 BHN. Hardening of wedge and safety block shall be done

7 DIMENSIONS

7.1 The dimensions for socket and pin — nut for socket cappels with open jaws shall be as given in Fig. 3A and 3B respectively.

7.2 The dimensions for tapered friction wedge cappels shall be as given in Fig. 4 [*see* Fig. 4A for wedge, Fig. 4B for safety block, Fig. 4C for hoop of SWL of 50 kN, 80 kN and 100 kN cappel and Fig. 4D for hoop of SWL of 120 kN, 150 kN and 200 kN cappel].

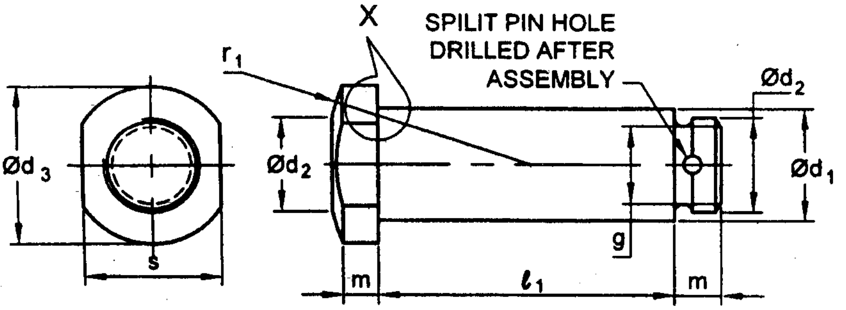


Rope Dia-meter	Seizing Wire Ø	Safe Working Load kN	Proof Load kN	*A*	*B*	*C*		*D*	*E*	*F*	*G*		*J*		*K*	*L*	*M*		*N*	*P*	R_1	R_2	d_1	*S*	*U*	*V*	*W*	*T*
						Nom	Tolerance				Nom	Tolerance	Nom	Tolerance			Nom	Tolerance										
16	1.0	20	60	216	115	84	+0 –0.15	84	121	42	50	+0.15 –0	44	+0.1 –0	15	32	22	+0.075 –0	44	127	5	3	M8	19	63	10	40	20
19	1.0	30	90	251	127	95	+0 –0.22	95	138	48	57	+0.19 –0	48	+0.19 –0	20	40	25	+0.084 –0	50	146	6	3	M10	24	75	10	50	25
22	1.0	40	120	298	127	95	+0 –0.22	95	162	57	57	+0.19 –0	56	+0.19 –0	20	40	29	+0.084 –0.0	50	172	6	3	M10	24	75	10	50	25
25/26	1.6	50	150	340	162	120	+0 –0.22	121	186	65	72	+0.19 –0	63	+0.19 –0	30	50	33	+0.100 –0	63	197	10	6	M10	28	75	10	50	32
28/29	1.6	80	240	382	162	120	+0 –0.22	121	208	73	72	+0.19 –0	74	+0.19 –0	30	50	36	+0.100 –0	63	222	10	6	M10	28	75	10	50	32
32	1.6	100	300	420	198	146	+0 –0.25	146	232	81	88	+0.22 –0	78	+0.19 –0	30	60	40	+0.010 –0	75	244	10	6	M16	40	95	12	62	45
38	2.0	120	360	503	228	175	+0 –0.25	175	278	95	103	+0.22 –0	93	+0.22 –0	40	70	46	+0.0100 –0	90	296	12	6	M16	45	95	12	62	50
44	2.0	150	450	583	268	200	+0 –0.29	200	326	112	117	+0.22 –0	108	+0.22 –0	50	80	53	+0.120 –0	100	346	16	10	M18	50	112	16	75	56
51	2.0	200	600	666	292	226	+0 –0.29	226	372	127	132	+0.25 –0	122	+0.22 –0	50	90	60	+0.120 –0	112	394	16	10	M18	62	112	16	75	70

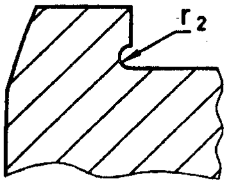
3A Socket for Socket Cappel

All dimensions in millimetres.

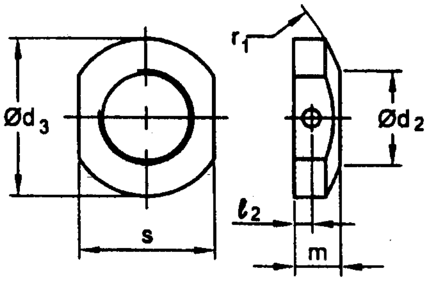
FIG. 3 SOCKET CAPPEL (*Continued*)



PIN



ENLARGED DETAIL AT X



NUT

Rope Diameter	d_1		d_2	d_3 Max	g	l_1		l_2	m	r_1	r_2	S Max	Split Pin Diameter
	Nom	Tol				Nom	Tol						
16	32	−0.075 −0.025	M 27	45.20	22.6	84	+0.260 +0.120	5	13	58	1.2	41	5.0
19	40	−0.087 −0.025	M 33	55.37	28.0	95	+0.260 +0.120	5	14	63	1.2	50	6.3
22	40	−0.087 −0.025	M 33	55.37	28.0	95	+0.260 +0.120	5	14	63	1.2	50	6.3
25/26	50	−0.087 −0.025	M 39	66.44	33.3	120	+0.260 +0.120	5	15	71	1.2	60	6.3
28/29	50	−0.087 −0.025	M 39	66.44	33.3	120	+0.260 +0.120	5	15	71	1.2	60	6.3
32	60	−0.104 −0.030	M 52	92.40	45.0	146	+0.305 +0.145	8	22	100	1.2	80	8.0
38	70	−0.104 −0.030	M 56	98	48.10	175	+0.305 +0.145	8	23	112	1.6	85	8.0
44	80	−0.104 −0.030	M 64	110	55.7	200	+0.385 +0.170	8	26	125	1.6	95	8.0
51	90	−0.123 −0.036	M 76	127	67.7	226	+0.385 +0.170	10	28	146	1.6	110	10.0

3B Pin and Nut for Socket Cappel

All dimensions in millimetres.

FIG. 3 SOCKET CAPPEL

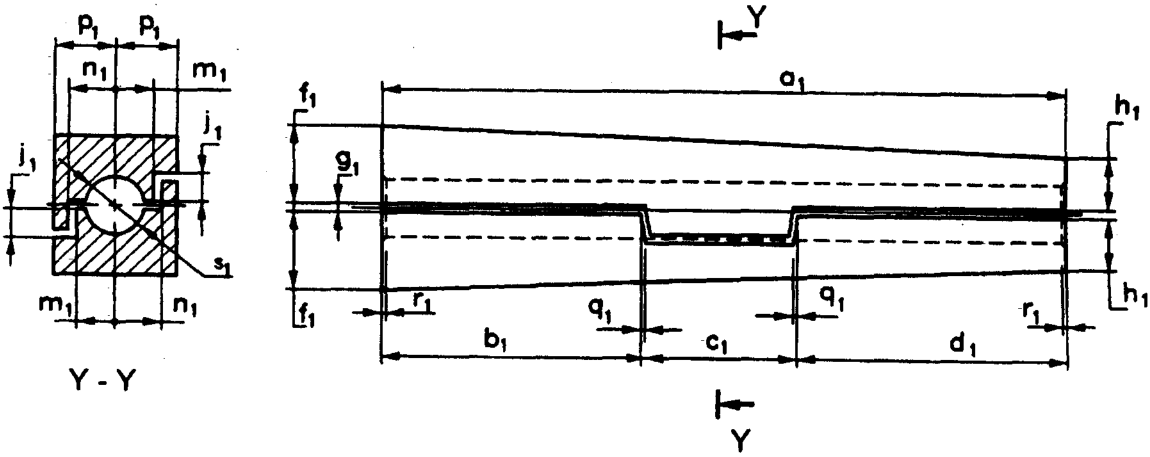
7.3 The dimensions not specified shall be as agreed to between the purchaser and the manufacturer.

7.4 Tolerances on Dimensions

The diameter of the pin hole shall have the following tolerances:

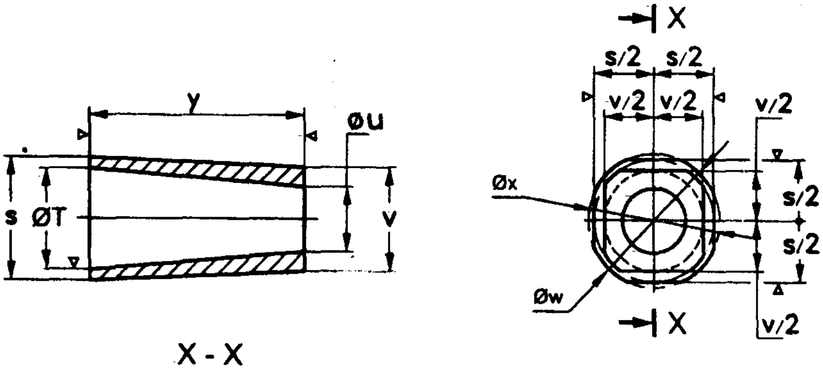
Up to and including 25 mm	$^{+0.40}_{-\ \ 0}$ mm
Over 25 mm	$^{+0.794}_{-\ \ 0}$ mm

7.5 The diameter of chase block with safety hook of 120, 150 and 200 kN SWL shall be less by 1.0 mm maximum than the diameter '*h*' in the tapered friction wedge capples [*see* Fig. 4D].



Rope Diameter, mm	SWL kN	a_1	b_1	c_1	d_1	f_1	g_1	h_1	j_1	m_1	n_1	p_1	q_1	r_1	s_1
25, 26	50	400	156	88	156	30	6	18.5	14	19.5	22.5	30	1.5	2	To suit the rope
27, 28, 29	80	455	180	100	175	34.5	6	19	15	22	25	33.5	2.5	2	
32	100	530	210	105	215	42	6	21	17	26.5	29.5	39	2.5	2	
35, 36, 38	120	550	221	108	221	44	6	22	20	27	32	42	3	2	
41, 42, 44	150	675	282	111	282	46	6	25	22	30	35	46	4	2	
48, 51	200	745	317	111	317	52	6	29	25	37	43	51.5	4	2	

4A Wedge

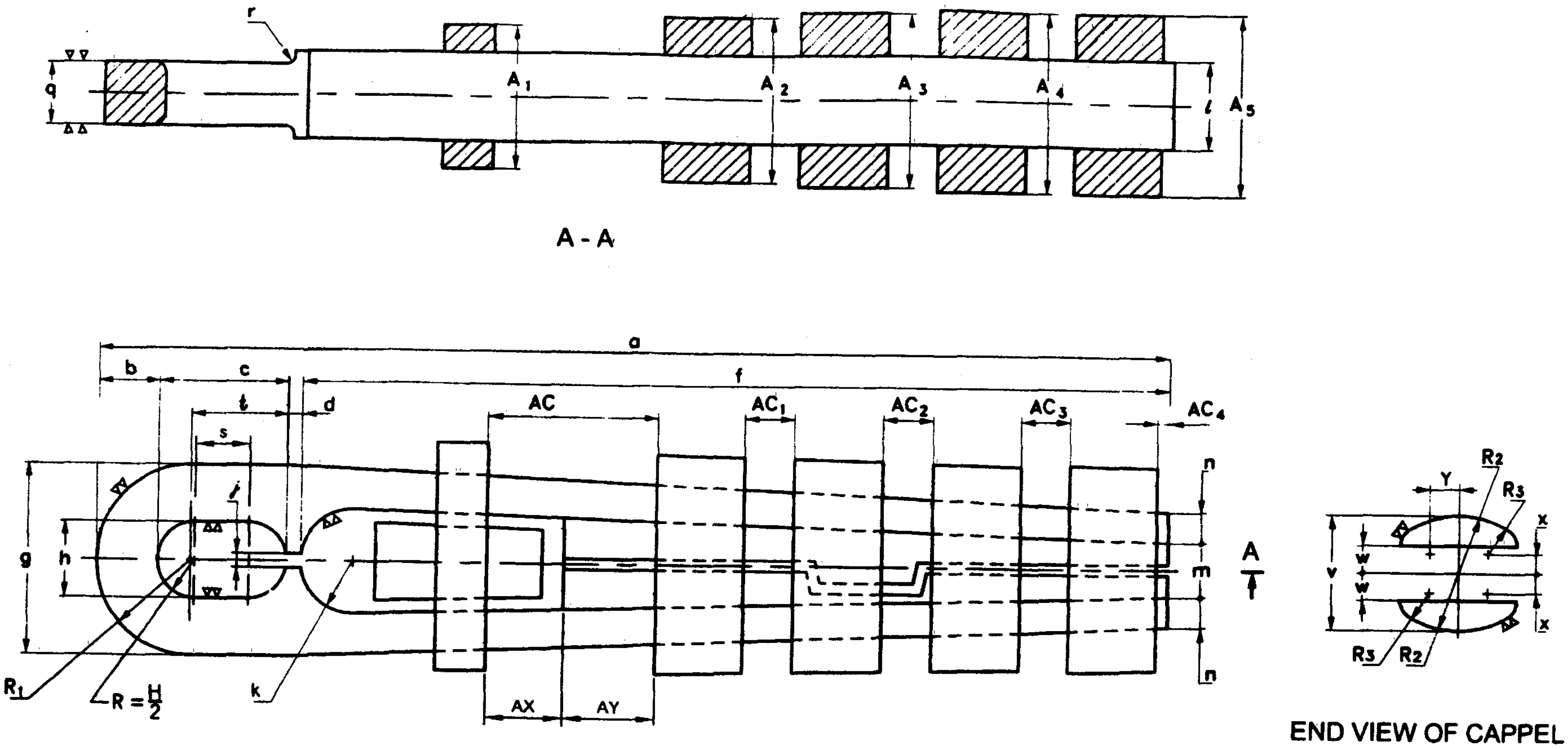


Rope Diameter mm	SWL kN	*S*	*T*	*U*	*V*	*W*	*X*	*Y*
25, 26	50	60	50	28	52	70	62	125
27, 28, 29	80	67	55	32	58	78	67	125
32	100	78	65	40	70	93	80	145
35, 36, 38	120	85	70	45	72	94	86	150
41, 42, 44	150	95	80	53	80	105	90	160
48, 51	200	100	85	60	90	120	104	170

4B Safety Block

All dimensions in millimetres.

FIG. 4 WEDGE CAPPEL (*Continued*)



END VIEW OF CAPPEL

DIMENSIONS R_2, R_3, V, W, X AND Z ARE ONLY FOR GUIDANCE AND SHALL BE ACCORDING TO MATING DIMENSIONS WITH CAPPEL BAND

Rope Diameter mm	SWL kN	Proof Load kN	a	b	c	d	f	g	h	j	k	m	n	q	R_1	s	t	r	R_2	R_3
25,26	50	150	725	40	90	13	582	118	58	10	36.5	43	20	41	63	32	90	12	42	18
27,28,29	80	240	800	55	100	15	630	135	60	12	43	44	22.5	45	72	40	110	12	44	18
32	100	300	925	55	110	15	745	156	65	12	52	48	25	58	79	45	100	15	50	22

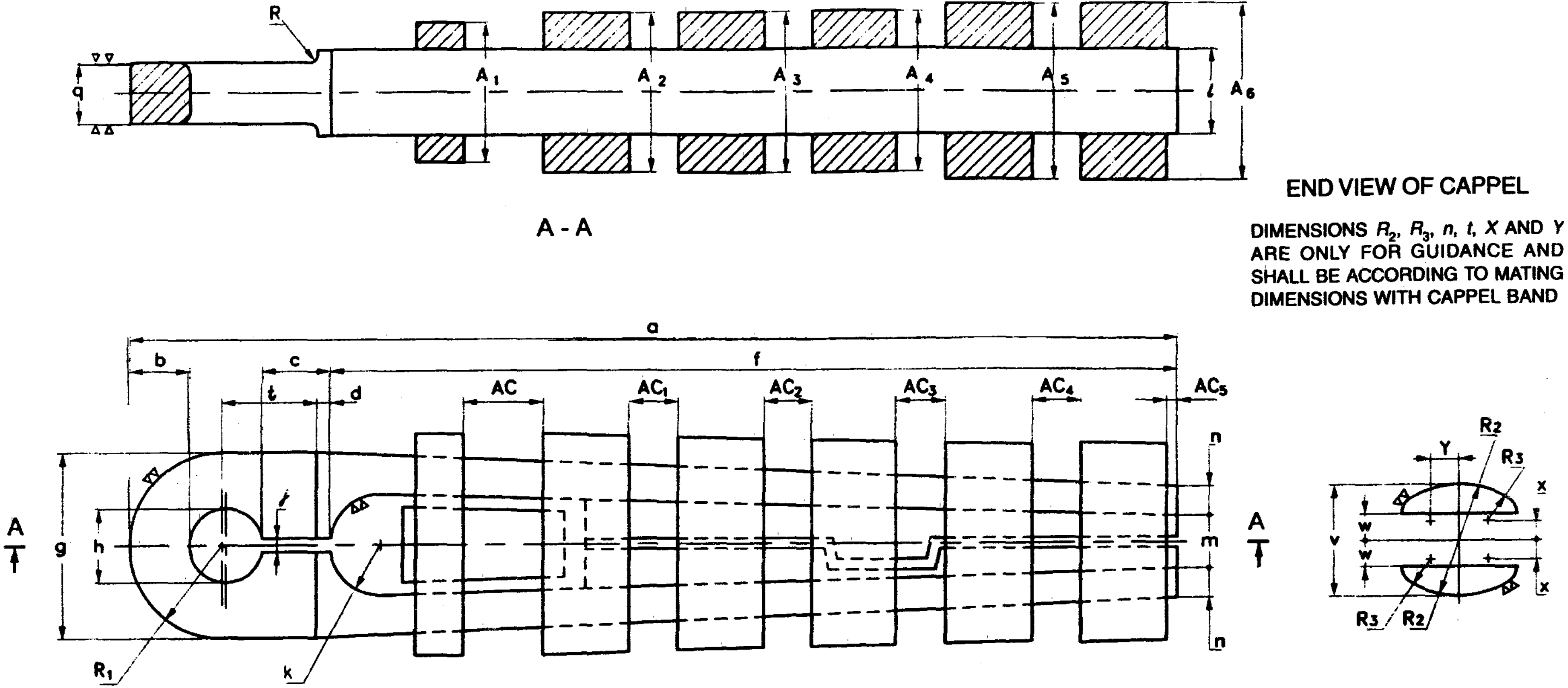
v[1)]	w[1)]	x[1)]	y[1)]	A_1	A_2	A_3	A_4	A_5	l	AC	AC_1	AC_2	AC_3	AC_4	AX	AY
83	21.5	20.5	12	92	112	112	112	—	62	150	47.5	47.5	—	10	50	100
86	22	18.5	17	96	122	122	122	122	72	142	35	35	35	10	50	92
98	24	23.5	19	123	144	144	158	158	83	150	40	40	40	10	50	100

[1)] Dimensions are for guidance only.

4C Cappel for SWL of 50, 80 and 100 kN

All dimensions in millimetres.

FIG. 4 WEDGE CAPPEL (*Continued*)


R
q
A1
A2
A3
A4
A5
l
A6
A - A
END VIEW OF CAPPEL
DIMENSIONS R2, R3, n, t, X AND Y ARE ONLY FOR GUIDANCE AND SHALL BE ACCORDING TO MATING DIMENSIONS WITH CAPPEL BAND
a
b
c
f
t
d
AC
AC1
AC2
AC3
AC4
AC5
n
m
n
A
A
g
h
j
R1
k
R2
R3
Y
x
v
w
w
x
R3
R2

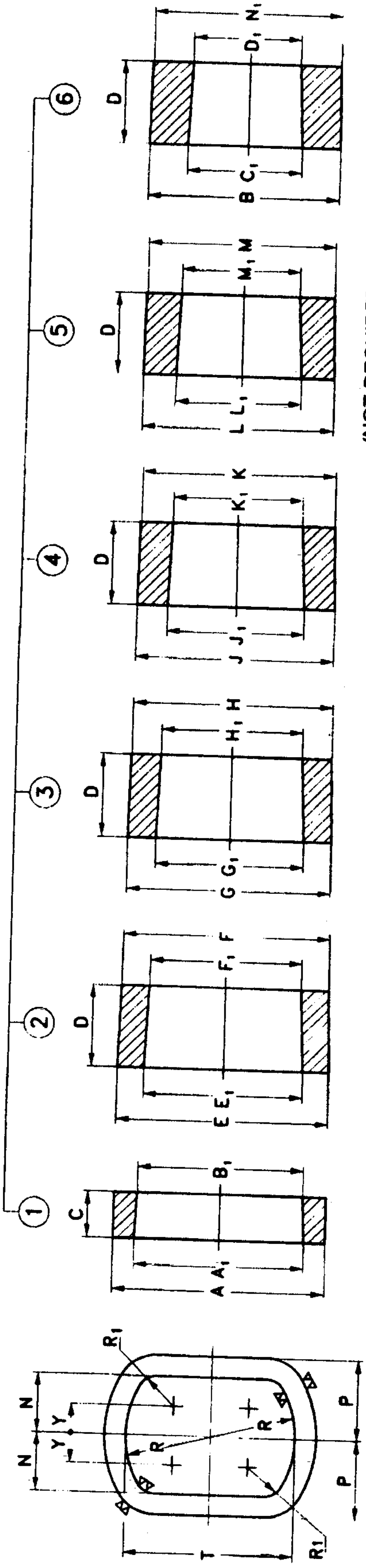
Rope Diameter mm	SWL kN	Proof Load kN	a	b	c	d	f	g	h	j	k	l	m	q	R	R_1	v	w	A_1	A_2	A_3	A_4	A_5	A_6	AC	AC_1	AC_2	AC_3	AC_4	AC_5
35, 36, 38	120	360	980	57	64	13	789	184	70	13	48	80	50	57	15	98	106	25	130	150	150	150	165	—	162	45	45	45	45	10
41, 42, 44	150	450	1120	63	70	15	905	200	82	15	55	95	56	70	15	105	116	28	140	160	160	160	175	175	152	50	50	50	50	10
48, 51	200	600	1230	70	77	15	988	232	95	15	61	105	64	76	15	122	130	32	155	175	175	175	190	190	181	60	60	60	60	10

Note – Dimensions R_2, R_3, n, t, x, y shown in the figure are for guidance only.

4D Cappel for SWL of 120, 150 and 200 kN

All dimensions in millimetres.

FIG. 4 WEDGE CAPPEL (*Continued*)



DIMENSIONS *N*, *T*, *P* AND *Y* ARE FREE AND FOR MATING WITH CAPPEL BAND

(NOT REQUIRED FOR Ø25,AND Ø26 ROPE)

(NOT REQUIRED FOR Ø25,Ø26, Ø27,Ø28,Ø29, Ø32 Ø35,Ø36 AND Ø38 ROPE)

Rope Diameter mm	SWL kN	A	A_1	B	B_1	C	D	E	E_1	F	F_1	G	G_1	H	H_1	J	J_1	K	K_1	L	L_1	M	M_1	Y	R	R_1	C_1	N_1	D_1
25, 26	50	140	110	—	109	33	65	150	100	147	97	144	94	141	91	138	88	135	85	—	—	—	—	18	40	18	—	—	—
27, 28, 29	80	148	124	—	122	38	60	162	112	157	107	155	105	150	100	149	99	144	94	142	92	137	87	18	44	18	—	—	—
32	100	186	146	—	143	38	75	191	131	186	126	181	121	176	116	183	113	178	108	174	104	169	99	19.5	50	22	—	—	—
35, 36, 38	120	210	160	—	158	45	80	210	147	205	142	202	138	197	133	196	130	191	125	190	121	185	116	—	53	—	—	—	—
41, 42, 44	150	228	175	202	172	45	85	233	160	227	154	225	150	219	144	224	140	218	134	211	131	205	125	—	58	—	122	196	116
48, 51	200	273	202	230	198	50	90	266	183	259	176	258	173	251	166	252	162	245	155	242	151	235	144	—	65	—	139	223	132

4E Solid Tapered Bands

All dimensions in millimetres.

FIG. 4 WEDGE CAPPEL

8 SCREW THREADS

The screw threads shall conform to IS 4218 (Parts 1 to 3) and IS 14962 (Parts 1 to 3).

9 WORKMANSHIP

9.1 The components shall be made by either forging or machining from solid rolled bar. The components shall be finished to the dimensions given in the respective figures after heat-treatment.

9.1.1 The cotter pin holes shall be drilled in one setting through the nut and the pin when the nut is properly seated on the shoulder of the pin.

9.1.2 All the fillet and external radii shall blend smoothly without undercut or step.

9.2 Band shall be manufactured from solid and shall be without any welding.

9.2.1 Bands shall be numbered serially from the top of the wedge.

10 DESIGNATION

Cappels shall be designated by the commonly used name, type, safe working load, diameter of wire rope employed for and the IS number.

Example: A cappel of Type A and of safe working load of 50 kN employed for 25/26 mm diameter wire rope shall be designated as:

Cappel A 50 × 25/26 IS 7587 (Part 2)

11 PROOF LOADING

11.1 Each complete assembly of cappel shall be subjected to the proof load test to the value specified in Fig. 3A, 4C and 4D as applicable. The proof load on the cappel shall be applied through a pair of split steel cones and an eyebolt.

11.1.1 The split cone and eyebolt used for proof load test shall be as shown in Fig. 5 and shall be in axial alignment with the cappel. The cone shall be of same length and taper as the basket of the cappel under test so as to ensure as far as possible, a full surface contact between the cone and the basket. The load on the pin shall be equally distributed throughout its length.

12 NON-DISTINCTIVE TESTING

Each assembly shall undergo non-destructive testing as described in IS 7587 (Part 1).

13 MARKING

13.1 Identification Marking

Each cappel shall be marked with the diameter of the rope for which it is employed, safe working load, and the manufacturer's identification mark.

13.2 BIS Certification Marking

Each component may also be marked with the BIS Standard Mark.

13.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

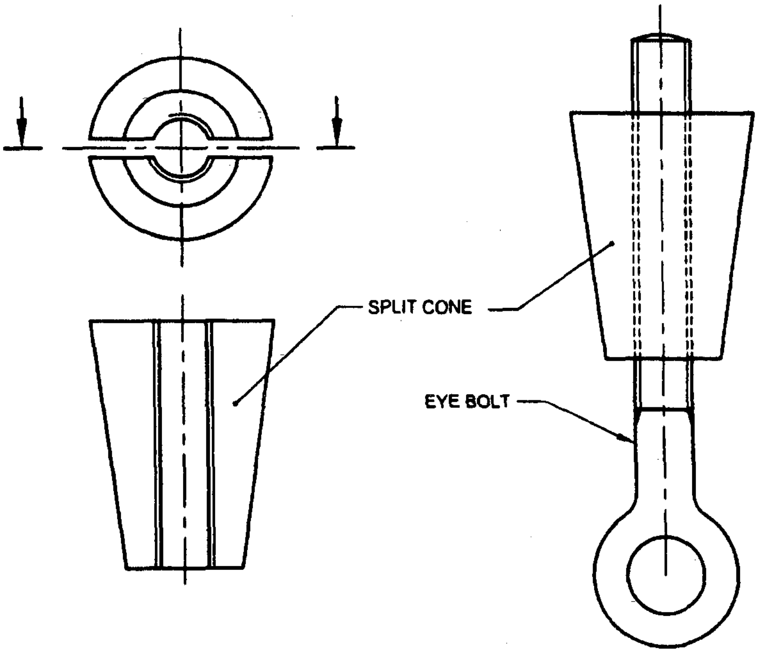


FIG. 5 SPLIT CONE AND EYE BOLT FOR TESTING SOCKETS

ANNEX A

(*Foreword*)

BRIEF DESCRIPTION OF DIFFERENT TYPES OF CAPPELS

A-1 CAPPELS IN COMMON USE

A-1.1 White Metal Socket Type

Solid machined white metal socket cappels with open jaws are widely used for connecting the winding rope to the suspension. The mouth of the socket is rounded to prevent damage to the rope and a short length of parallel bore is provided next to the mouth.

A-1.1.1 After carefully preparing and securely binding the rope with soft iron, seizing wire, antifriction bearing alloy is poured into the socket [*see* IS 3937 (Part 2)]. A properly carried out capping of the rope in the socket will withstand the breaking strength of the rope. The length of taper of the socket is usually not less than 6 times and not more than 8 times the diameter of the rope and the angle of taper is between 3° and 6°.

A-1.2 Tapered Friction Wedge Type

The rope is held between two grooved and interlocking wedges which cannot move independently of each other. The wedges are placed inside the tapered limbs of the hoop which hold the wedges in position by virtue of the retaining bands driven over the limbs.

A-1.2.1 As the retaining tapered bands force the limbs of the hoop together, the wedges hold the rope with increasing force. Such cappels give a holding power greater than the strength of the rope. A cast steel safety block is fitted at the end of the rope, below the wedges as a safety precaution to start the wedges moving in the unlikely event of rope movement in the wedges. Bands used in friction wedge cappel are numbered serially either from the bottom or from the top.

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Mining Techniques and Equipment Sectional Committee, ME 08

Organization	*Representative(s)*
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This Indian Standard has been developed from Doc : No. **ME 08 (0781).**

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Printed at New India Printing Press, Khurja, India